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PAJ

TI - SUBCLINICAL MASTITIS DIAGNOSING METHOD FOR DAIRY COW AND ITS DEVICE

AB - PURPOSE:To allow a dairy farmer to simply discover the subclinical mastitis of a dairy cow at an early stage.
- CONSTITUTION:In the subclinical mastitis diagnosing method of a dairy cow, milk is individually drawn from multiple mammae of a dairy cow, the milk quantity from each mamma is detected in each milking work, the ratio of the milk quantity of each mamma against the total milk quantity is calculated based on the detected milk quantity, the present calculated ratio is compared with the past calculated ratio for each mamma. If the present calculated ratio differs from the past calculated ration by a preset value or above, the mamma is diagnosed to suffer with subclinical mastitis. A subclinical mastitis diagnosing device of a dairy cow is provided with a processing means 21 calculating the ratio of the milk quantity of each mamma against the total milk quantity and storing the calculated ratio and a diagnosing means 22 comparing the present calculated ratio with the stored information of the processing means for each mamma and diagnosing the mamma to suffer with subclinical mastitis when the preset calculated ratio is changed from the stored information of the processing means by a preset value or above.

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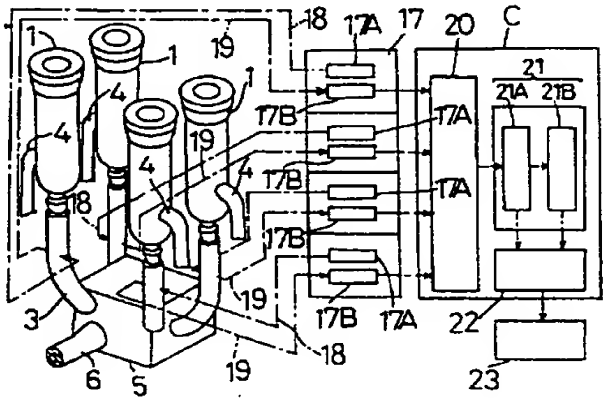
(54)【発明の名称】　乳牛の潜在性乳房炎診断方法及び潜在性乳房炎診断装置

(57)【要約】　(修正有)

【目的】　乳牛の潜在性乳房炎を酪農家にて簡単且つ早期に発見できる診断方法及び診断装置の提供。

【構成】　乳牛の複数の乳房夫々から各別に乳汁を搾乳して、各乳房からの搾乳量を搾乳作業毎に検出し、その検出搾乳量に基づいて、全体搾乳量に対する各乳房の搾乳量の割合を算出し、乳房別に今回の算出割合と過去の算出割合とを比較して、今回の算出割合が過去の算出割合に比して所定値以上変化すれば、その乳房が潜在性乳房炎であると診断する乳牛の潜在性乳房炎診断方法。又、全体搾乳量に対する各乳房の搾乳量の割合を算出しその算出割合を記憶する処理手段２１が設けられ、乳房別に今回の算出割合と処理手段の記憶情報とを比較して、今回の算出割合が処理手段の記憶情報に比して所定値以上変化すれば、その乳房が潜在性乳房炎であると診断する診断手段２２が設けられている乳牛の潜在性乳房炎診断装置。



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【特許請求の範囲】

【請求項1】　乳牛の複数の乳房夫々から各別に乳汁を搾乳して、各乳房からの搾乳量を搾乳作業毎に検出し、その検出搾乳量に基づいて、全体搾乳量に対する各乳房の搾乳量の割合を算出し、乳房別に今回の算出割合と過去の算出割合とを比較して、今回の算出割合が過去の算出割合に比して所定値以上変化すれば、その乳房が潜在性乳房炎であると診断する乳牛の潜在性乳房炎診断方法。

【請求項2】　乳牛の複数の乳房夫々から各別に乳汁を搾乳する複数の搾乳手段（1）夫々の搾乳量を搾乳作業毎に検出する検出手段（17），（18），（19），（20）が設けられ、その検出搾乳量に基づいて、全体搾乳量に対する各乳房の搾乳量の割合を算出し且つその算出割合を記憶する処理手段（21）が設けられ、乳房別に今回の算出割合と前記処理手段（21）の記憶情報とを比較して、今回の算出割合が前記処理手段（21）の記憶情報に比して所定値以上変化すれば、その乳房が潜在性乳房炎であると診断する診断手段（22）が設けられている乳牛の潜在性乳房炎診断装置。

【発明の詳細な説明】

【0001】

【産業上の利用分野】本発明は、乳牛の潜在性乳房炎診断方法及び潜在性乳房炎診断装置に関する。

【0002】

【従来の技術】乳牛が乳房炎に感染すると、搾乳量が減少したり乳質が変化して出荷できなくなり、酪農家に対して経済的損失を与えるため、乳房炎を臨床型乳房炎に至る前の潜在性乳房炎の段階で、しかも、できるだけ早期に発見して対処することが要求される。ところで、臨床型乳房炎は、搾乳した乳汁中に薄片、凝固等の異常が生じ、又、感染した乳房に高熱、腫張等の異常が生じるため、肉眼にて発見できるのに比して、潜在性乳房炎は、肉眼にて発見できない。

【0003】そこで、従来は、各乳牛から搾乳した乳汁中の体細胞数を測定し、その測定体細胞数が所定値以上であれば、その乳牛が潜在性乳房炎に感染していると診断する方法により、乳牛の潜在性乳房炎の発見を行っていた。

【0004】

【発明が解決しようとする課題】しかしながら、上記従来の乳牛の潜在性乳房炎診断方法は、専門の技術及び特殊な装置が必要であるため、酪農家で実施することができず、専門の機関に依頼して実施する必要があった。又、そのために、短期間のサイクルで実施できず、例えば月に一回といった比較的長期間のサイクルで実施するので、早期発見ができないという問題があった。

【0005】本発明は、かかる実情に鑑みてなされたものであり、その目的は、乳牛の潜在性乳房炎を酪農家にて簡単に且つ早期に発見できる潜在性乳房炎診断方法及び潜在性乳房炎診断装置を提供する点にある。

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【0006】

【課題を解決するための手段】本発明の第1の特徴構成である乳牛の潜在性乳房炎診断方法は、乳牛の複数の乳房夫々から各別に乳汁を搾乳して、各乳房からの搾乳量を搾乳作業毎に検出し、その検出搾乳量に基づいて、全体搾乳量に対する各乳房の搾乳量の割合を算出し、乳房別に今回の算出割合と過去の算出割合とを比較して、今回の算出割合が過去の算出割合に比して所定値以上変化すれば、その乳房が潜在性乳房炎であると診断する点にある。

【0007】本発明の第2の特徴構成である乳牛の潜在性乳房炎診断装置は、乳牛の複数の乳房夫々から各別に乳汁を搾乳する複数の搾乳手段夫々の搾乳量を搾乳作業毎に検出する検出手段が設けられ、その検出搾乳量に基づいて、全体搾乳量に対する各乳房の搾乳量の割合を算出し且つその算出割合を記憶する処理手段が設けられ、乳房別に今回の算出割合と前記処理手段の記憶情報とを比較して、今回の算出割合が前記処理手段の記憶情報に比して所定値以上変化すれば、その乳房が潜在性乳房炎であると診断する診断手段が設けられている点にある。

【0008】

【作用】通常、乳牛の複数の乳房のうちの全てが潜在性乳房炎に感染するのではなく、一つないし二つが感染し、且つ、潜在性乳房炎に感染した乳房からの出乳量が低減することが知られており、本発明は、この点に着目してなされたものである。

【0009】本発明の第1の特徴構成によれば、搾乳作業毎に、各乳房からの搾乳量を検出し、その検出搾乳量に基づいて、全体搾乳量に対する各乳房の搾乳量の割合を算出する。そして、乳房別に今回の算出割合と過去の算出割合とを比較することにより出乳量の低減を判別して、今回の算出割合が過去の算出割合に比して所定値以上変化して出乳量の低減した乳房を、潜在性乳房炎であると診断する。

【0010】ちなみに、各乳房からの搾乳量において今回の値と過去の値とを比較することにより、各乳房からの出乳量の低減を判別する方法が想定される。しかしながら、通常、各乳房からの搾乳量は、乳牛の体調の変化に起因して、潜在性乳房炎に感染していなくても搾乳作業毎に変動するために、前述の方法のものでは、潜在性乳房炎に感染したときの出乳量の低減が正確に判別できないのに比して、本発明であれば、搾乳作業毎の全体搾乳量に対する各乳房の搾乳量の割合において今回の値と過去の値とを比較するので、前記乳牛の体調の変化に起因した搾乳量の変動が除外できて、出乳量の低減が正確に判別できる。

【0011】本発明の第2の特徴構成によれば、搾乳作業毎に、検出手段夫々は、搾乳手段夫々の搾乳量を検出し、その検出搾乳量に基づいて、処理手段は、全体搾乳

量に対する各乳房の搾乳量の割合を算出し且つその算出割合を記憶する。そして、診断手段は、乳房別に今回の算出割合と処理手段の記憶情報とを比較して、今回の算出割合が処理手段の記憶情報に比して所定値以上変化すれば、その乳房が潜在性乳房炎であると診断する。

【００１２】

【発明の効果】第１の特徴構成によれば、搾乳作業毎に、各乳房からの搾乳量を検出し、その検出搾乳量に基づいて、全体搾乳量に対する各乳房の搾乳量の割合を算出して、乳房別に今回の算出割合と過去の算出割合とを比較するだけで、乳房が潜在性乳房炎に感染していることが診断でき、しかも、それを、例えば毎日行う搾乳作業毎に実施できるので、その結果、乳牛の潜在性乳房炎を酪農家にて極めて簡単に且つ早期に発見できる潜在性乳房炎診断方法を提供し得るに至った。

【００１３】第２の特徴構成によれば、上記第１の特徴構成に述べた乳牛の潜在性乳房炎診断方法を実現するための好適な乳牛の潜在性乳房炎診断装置を提供し得るに至った。

【００１４】

【実施例】以下、本発明を搾乳装置に適用した実施例について、図面に基づいて説明する。先ず、図３及び図４に基づいて、搾乳装置の全体構成について説明する。

【００１５】図中の１は、乳牛の乳房２に装着して乳汁を搾乳する搾乳手段としてのティートカップであり、乳牛の四つの乳房２夫々から各別に乳汁を搾乳するように四つのティートカップ１を備えてある。ティートカップ１は、図３に示すように、硬い材質で形成された外側筒状体１Ａに、ゴム等の柔らかい材質で形成された内側筒状体１Ｂを、その内側筒状体１Ｂの一端側を外側筒状体１Ａの一端側開口部に挿通し且つその挿通部を気密状態にする状態で、且つ、内側筒状体１Ｂの他端側開口部と外側筒状体１Ａの他端側開口部とを気密状態にて接続する状態にて内装してある。

【００１６】そして、図３に示すように、内側筒状体１Ｂの開口部で形成されるティートカップ１の装着口１Ｃを、乳房２の乳頭２Ａに装着した状態で、乳頭２Ａと内側筒状体１Ｂとにより形成される内室１ａに連通する状態で乳汁用短管３を接続し、且つ、外側筒状体１Ａと内側筒状体１Ｂとの間に形成される外室１ｂに連通する状態で空気用短管４を接続してある。

【００１７】クロー５により、四つのティートカップ１夫々からの四本の乳汁用短管３夫々が一本の乳汁用長管６に連通接続し、且つ、四つのティートカップ１夫々からの四本の空気用短管４夫々が一本の空気用長管７に連通接続する状態としてある。

【００１８】乳汁用長管６を乳汁用パイプライン８に接続し、この乳汁用パイプライン８は、受乳容器９、サニタリートラップ１０、調圧器１１、及び、真空タンク１２夫々を介して、真空ポンプ１３に接続してある。尚、

受乳容器９はティートカップ１にて搾乳した乳汁を溜めるために、サニタリートラップ１０は乳汁が受乳容器９から調圧器１１へ流れないようにするために設けてある。又、空気用長管７は、パルセータ１４を介して、空気用パイプライン１５に接続してあり、その空気用パイプライン１５は、サニタリートラップ１０、調圧器１１、及び、真空タンク１２夫々を介して、真空ポンプ１３に接続してある。尚、パルセータ１４は、空気用長管７が空気用パイプライン１５に連通して真空ポンプ１３に接続される状態と大気に開放される状態とに周期的に切り換えることにより、ティートカップ１の外室１ｂを真空状態と大気圧状態とに周期的に切り換える。又、１６は、受乳容器９内の乳汁を外部に排出する乳汁用ポンプである。

【００１９】そして、ティートカップ１、乳汁用短管３、空気用短管４、クロー５、乳汁用長管６、空気用長管７、及び、パルセータ１４から構成される搾乳ユニットＵの複数を、乳汁用パイプライン８及び空気用パイプライン１５に対して接続してあり、複数の乳牛から同時に乳汁を搾乳できるようにしてある。

【００２０】次に、図３に基づいて、ティートカップ１により乳牛の乳房２から乳汁を搾乳する方法について説明する。

【００２１】四つのティートカップ１の内室１ａ夫々は、乳汁用短管３、クロー５、乳汁用長管６、乳汁用パイプライン８、受乳容器９、サニタリートラップ１０、調圧器１１、及び、真空タンク１２夫々を介して、真空ポンプ１３に接続し、又、四つのティートカップ１の外室１ｂ夫々は、空気用短管４、クロー５、空気用長管７、パルセータ１４、空気用パイプライン１５、サニタリートラップ１０、調圧器１１、及び、真空タンク１２夫々を介して、真空ポンプ１３に接続している。

【００２２】従って、ティートカップ１の装着口１Ｃを乳房２の乳頭２Ａに装着した状態で、ティートカップ１の内室１ａは、常時、真空状態が導かれ、一方、ティートカップ１の外室１ｂは、パルセータ１４により、内室１ａとほぼ同じ真空度の真空状態と大気圧状態とに周期的に切り換えるようにしてある。即ち、外室１ｂが真空状態のときは、内室１ａと外室１ｂとはほぼ同じ圧力になって、図３の（イ）に示すように、内側筒状体１Ｂは筒形状が保持されるので、内室１ａの真空が乳頭２Ａに作用して乳汁が吸い出される状態となり、一方、外室１ｂが大気圧状態のときは、外室１ｂの圧力が内室１ａよりも高くなって、図３の（ロ）に示すように、内側筒状体１Ｂが押しつぶされるので、内室１ａの真空が乳頭２Ａに作用しなくなって乳汁が吸い出されずに、内側筒状体１Ｂが乳頭２Ａに押しつけられて乳頭２Ａが圧迫される状態となる。もって、乳頭２Ａから乳汁が吸い出される状態と乳頭２Ａが圧迫される状態とを周期的に繰り返すことにより、乳房２から間欠的に乳汁を搾乳するよう

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にしてある。

【0023】上述の如く、四つのティートカップ1夫々により搾乳した乳汁は、四本の乳汁用短管3夫々を流れて、クロー5内で一か所に集まる状態で乳汁用長管6に流入し、そして、乳汁用長管6を流れて乳汁用パイプライン8に流入し、そして、乳汁用パイプライン8を流れて受乳容器9に流入するのである。

【0024】次に、図1及び図2に基づいて、潜在性乳房炎診断装置について説明する。

【0025】図中の17は、発光部17Aと受光部17Bとを備える光センサであり、18は、光センサ17の発光部17Aからの光を導いて乳汁用短管3内を横切る状態で乳汁用短管3内に投光する光ファイバー製の投光用光ガイドであり、19は、投光用光ガイド18から投光された光を受光して光センサ17の受光部17Bに導く光ファイバー製の受光用光ガイドである。具体的には、図2に示すように、投光用光ガイド18の端面18aが乳汁用短管3の管内に臨む状態で、投光用光ガイド18の一端部を乳汁用短管3の管壁に挿設してあり、一方、受光用光ガイド19の端面19aが乳汁用短管3の管内に臨み且つ投光用光ガイド18の端面18aに対面する状態で、受光用光ガイド19の一端部を乳汁用短管3の管壁に挿設してある。

【0026】つまり、乳汁用短管3内を通流する乳汁の流量の変化に伴って、投光用光ガイド18の端面18aから投光された光の透過光量が変化して、受光用光ガイド19に導かれて受光部17Bが受光する光量が変化する。そして、搾乳作業毎に、搾乳作業中にわたって受光部17Bからの光量変化に伴った出力信号を、マイクロコンピュータを利用した制御部Cにおける計量処理部20にて積分演算処理して、ティートカップ1の搾乳量を算出するようにしてある。即ち、光センサ17、投光用光ガイド18、受光用光ガイド19、及び、計量処理部20をもって、ティートカップ1の搾乳量を搾乳作業毎に検出する検出手段として機能させるように構成してある。そして、前述の如く構成した検出手段を、四つのティートカップ1夫々に設けてある。

【0027】21は、制御部Cにおける処理部であり、搾乳作業毎に、計量処理部20におけるティートカップ1夫々の搾乳量の算出結果に基づいて、処理部21の演算部21Aにて、ティートカップ1夫々の算出搾乳量を四つのティートカップ1夫々の算出搾乳量の合計値にて除することにより、全体搾乳量に対する各乳房の搾乳量の割合を算出し、且つ、その算出割合を処理部21の記憶部21Bにて記憶するようにしてある。

【0028】そして、制御部Cにおける診断部22にて、処理部21の記憶部21Bに記憶されている過去の算出割合の記憶情報に基づいて、乳房別に、過去の算出

6

割合の平均値を算出し、且つ、処理部21の演算部21Aにて算出された今回の算出割合と前記算出平均値とを比較して、今回の算出割合が前記算出平均値に比して所定値（例えば、5％）以上小さい場合は、その乳房が潜在性乳房炎症であると診断し、その診断結果を四つの乳房のうちのどの乳房かを識別できる状態で表示部23に表示するようにしてある。例えば、四つの乳房夫々に異なる記号を設定し、潜在性乳房炎症と診断した乳房の記号と、今回の算出割合と前記算出平均値との差を表示する。

【0029】〔別実施例〕次に別実施例を列記する。

① 上記実施例では、発光部17Aからの光を投光用光ガイド18にて導いて乳汁用短管3内を横切る状態で乳汁用短管3内に投光し、投光用光ガイド18から投光された光を、受光用光ガイド19にて受光して光センサ17の受光部17Bに導くように構成する場合について例示したが、これに代えて、光センサ17の発光部17Aを、乳汁用短管3内を横切る状態で乳汁用短管3内に投光するように、乳汁用短管3の管内に臨む状態で乳汁用短管3の管壁に挿設し、且つ、光センサ17の受光部17Bを、発光部17Aからの光を受光するように、乳汁用短管3の管内に臨み且つ発光部17Aに対向する状態で乳汁用短管3の管壁に挿設するようにしても良い。

【0030】② 診断部22にて今回の算出割合と処理部21の記憶部21Bの記憶情報とを比較するに、上記実施例では、処理部21の記憶部21Bに記憶されている過去の算出割合の平均値を算出し、今回の算出割合と前記算出平均値とを比較する場合について例示したが、これに代えて、今回の算出割合と処理部21の記憶部21Bに記憶されている過去の算出割合の内の最近の算出割合とを比較するようにしても良い。

【0031】尚、特許請求の範囲の項に図面との対照を便利にするために符号を記すが、該記入により本発明は添付図面の構成に限定されるものではない。

【図面の簡単な説明】

【図1】潜在性乳房炎診断装置の構成図

【図2】潜在性乳房炎診断装置における検出手段の取付け構造を示す断面図

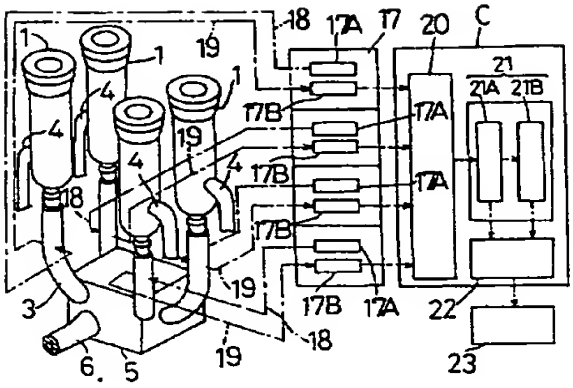
【図3】潜在性乳房炎診断装置における搾乳手段による搾乳作用を説明する断面図

【図4】潜在性乳房炎診断装置を適用した搾乳装置の全体構成図

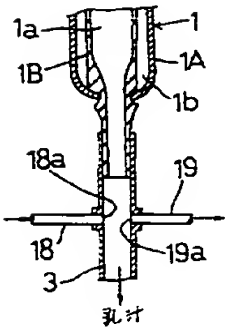
【符号の説明】

1	搾乳手段
17，18，19，20	検出手段
21	処理手段
22	診断手段

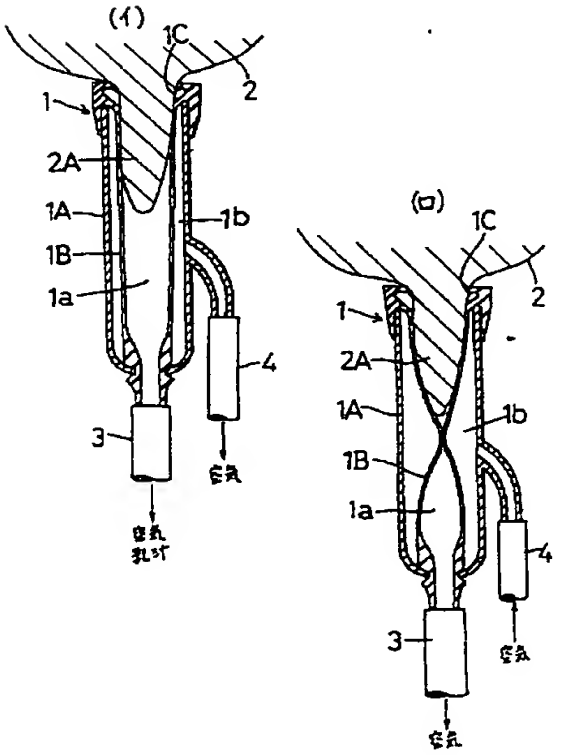
【図1】


1
19
18
17A
17
20
C
21
21A
21B
17B
4
3
6
5
22
23

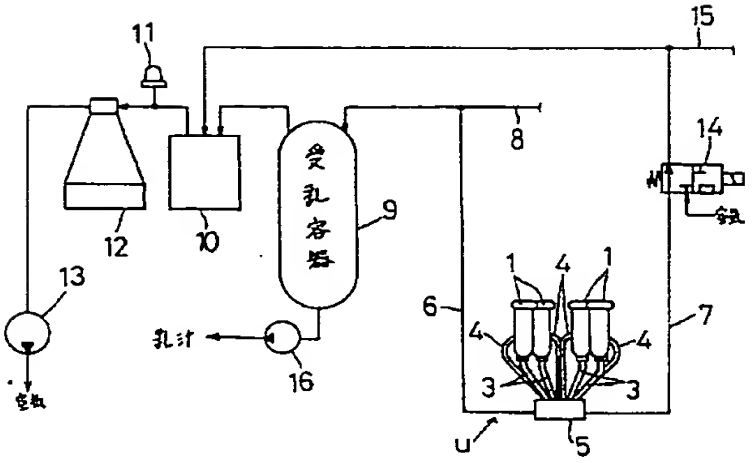
【図2】


1a
1
1B
1A
1b
18a
19
18
19a
3
乳汁

【図3】


(イ)
1C
2
1
2A
1A
1b
1B
1a
4
3
空気
乳汁
(ロ)
1C
2
1
2A
1A
1b
1B
1a
4
3
空気
空気

【図4】



[Document Name] Specification

[Title of the Invention]

Method and Apparatus for Diagnosing Latent Mastitis of a Cow

[Claims]

[Claim 1]

A method for diagnosing latent mastitis of a cow comprising the steps of:

milking milk from each of a plurality of breasts of a cow;

detecting the milking quantity of each breast every milking job;

calculating a rate of the milking quantity of each breast to the total milking quantity based on the detected milking quantity;

comparing a present calculation rate and a past calculation rate with each other by the breast; and

diagnosing that the breast is latent mastitis if the present calculation rate is varied by a predetermined value or more compared with the past calculation rate.

[Claim 2]

An apparatus for diagnosing latent mastitis of a cow comprising:

a plurality of milking means (1) for milking milk from each of a plurality of breasts of a cow;

detecting means (17), (18), (19), and (20) for detecting respective milking quantities every milking job;

processing means (21) for calculating a rate of the milking quantity of each breast to the total milking quantity and storing the calculation rate; and

diagnosing means (22) for, when the present calculation rate is compared with the storage information of said processing means (21) for each breast, if the present calculation rate is varied by a predetermined value or more compared with the storage information of said processing means (21), diagnosing that the breast is latent mastitis.

[Detailed Description of the Invention]

[0001]

[Field of the Invention]

The present invention relates to a method and apparatus for diagnosing latent mastitis of a cow.

[0002]

[Prior Art]

If a cow is infected with mastitis, a milking quantity decreases, milk quality changes, and milk products cannot be shipped, resulting in a financial loss of dairy farmers. It is required to find and treat mastitis at a stage of latent mastitis before it reaches clinical mastitis, and moreover, at the earliest state. In clinical mastitis, abnormalities such as generation of thin pieces, coagulation or the like occur in milked milk, and abnormalities such as fever, swelling or the like occur with an infected breast. These abnormalities can be visually found out; and however, latent mastitis cannot be visually found out.

[0003]

Therefore, conventionally, there has been employed a method for measuring the number of somatic cells in the milked milk from each cow; and detecting that the cow is infected with latent mastitis if

the number of the measured somatic cells is a predetermined value or more, thereby finding out latent mastitis of a cow.

[0004]

[Problems to be Solved by the Invention]

However, the conventional method for diagnosing latent mastitis of a cow requires specialized techniques and special apparatuses. It has been necessary to implement such diagnosis by arranging for the associated diagnostic specialists to do so, because the diagnosis cannot be implemented by dairy farmers. Therefore, there has been a problem that such kind of diagnosis cannot be implemented in a short cycle and thus in a relatively long cycle, for example, once a month, making it impossible to find mastitis at an earlier stage.

[0005]

The present invention has been attained in view of such circumstances. It is an object of the present invention to provide a method and apparatus for diagnosing latent mastitis capable of finding latent mastitis of a cow simply and at an earlier stage by dairy farmers.

[0006]

[Means for Solving the Problems]

As a first aspect of the present invention, there is provided a method for diagnosing latent mastitis of a cow comprising the steps of: milking milk from each of a plurality of breasts of a cow; detecting the milking quantity of each breast every milking job; calculating a rate of the milking quantity of each breast to the total milking quantity based on the detected milking quantity; comparing a present calculation rate and a past calculation rate for each breast; and diagnosing that the breast is latent mastitis if the present

calculation rate is varied by a predetermined value or more compared with the past calculation rate.

[0007]

As a second aspect of the present invention, there is provided an apparatus for diagnosing latent mastitis of a cow comprising: a plurality of milking means for milking milk from each of a plurality of breasts of a cow; detecting means for detecting respective milking quantities every milking job; processing means for calculating a rate of the milking quantity of each breast to the total milking quantity and storing the calculation rate; and diagnosing means for, when the present calculation rate compared with the storage information of said processing means for each breast, if the present calculation rate is varied by a predetermined value or more compared with the storage information of said processing means, diagnosing that the breast is latent mastitis.

[0008]

[Operation]

In general, it is known that all of a plurality of breasts of a cow are not infected with latent mastitis, but one or two breasts are infected, and a milking quantity of the infected breasts with latent mastitis is reduced. The present invention has been attained in view of this point.

[0009]

According to the first aspect of the present invention, the milking quantity of each breast is detected, and a rate of the milking quantity of each breast to the total milking quantity is calculated based on the detected milking quantity. The present calculation rate and the past calculation rate are compared with each other by the breast,

thereby discriminating reduction of the milking quantity. When the present calculation rate is varied by a predetermined value or more compared with the past calculation rate, a breast whose milking quantity has been reduced is diagnosed to be latent mastitis.

[0010]

Namely, in the milking quantity of each breast, it is presumed to use a method for comparing the present and past values with each other, thereby discriminating reduction of the milking quantity of each breast. However, in general, the milking quantity of each breast is varied every milking job due to a change in physical conditions of a cow even if it is not infected with latent mastitis. Thus, in the above mentioned conventional method, it is impossible to precisely discriminate reduction of the milking quantity when cow is infected with latent mastitis. In contrast, according to the present invention, the present and past values are compared with each other at a rate of the milking quantity of each breast to the total milking quantity every milking job. Therefore, the variation of the milking quantity caused by a change in physical conditions of the cow can be excluded, and the reduction of the milking quantity can be precisely discriminated.

[0011]

According to the second aspect of the present invention, detecting means detects the milking quantity of milking means every milking job. Based on the detected milking quantity, processing means calculates a rate of the milking quantity of each breast to the total milking quantity, and stores the calculation rate. In addition, diagnosing means compares the present calculation rate with storage information of the processing means by the breast. If the present

calculation rate is varied by a predetermined value or more compared with the storage information of the processing means, the diagnosing means diagnoses that the breast is latent mastitis.

[0012]

[Advantages of the Invention]

According to the first aspect, the milking quantity of each breast is detected every milking job; a rate of the milking quantity of each breast to the total milking quantity is calculated based on the detected milking quantity; and the present and past calculation rates are merely compared with each other by the breast, making it possible to diagnose that the breast is infected with latent mastitis. Moreover, such diagnosis can be implemented every milking job to be done every day. As a result, there can be provided a method for diagnosing latent mastitis capable of finding latent mastitis of a cow very simply and at an earlier stage by dairy farmers.

[0013]

According to the second aspect, there can be provided a preferable apparatus for diagnosing latent mastitis of a cow for attaining the method for diagnosing latent mastitis of a cow stated in the first aspect.

[0014]

[Embodiment]

Hereinafter, an embodiment of the present invention applied to a milking apparatus will be described with reference to the accompanying drawings.. First, the entire structure of the milking apparatus will be described by referring to Figure 3 and Figure 4.

[0015]

In the figures, reference numeral 1 designates a teat cup as milking means for milking milk by attaching it to breasts 2 of a cow. Four teat cups are provided for milking the milk from each of the four breasts 2 of a cow. In the teat cup 1, as shown in Figure 3, an internal cylinder body 1B made of a soft material such as rubber or the like is inserted through an external cylinder body 1A made of a hard material. One end of the internal cylinder body 1B is inserted through an opening at one end of the external cylinder body 1A, and the insert portion is placed in air tightness. In addition, an opening on the other end of the internal cylinder body 1B is internally connected to an opening on the other end of the external cylinder body 1A in air tightness.

[0016]

As shown in Figure 3, an attachment port 1C of the teat cup 1 formed at an opening of the internal cylinder body 1B is attached to a teat 2A of the breast 2. In this state, a short milking tube 3 is connected while the tube communicates with an internal chamber 1a formed by the teat 2A and the internal cylinder body 1B; and a short air tube 4 is connected to its required portion while the tube communicates with an external chamber 1b formed between the external cylinder body 1A and the internal cylinder body 1B.

[0017]

Each of four short milk tubes 3 from each of four teat cups 1 communicates with and is connected to one long milk tube 6 by means of a claw 5; and each of four short air tubes 4 from each of the four teat cups 1 communicates with and is connected to one long air tube 7.

[0018]

The long milk tube 6 is connected to a milk pipeline 8. This milk pipeline 8 is connected to a vacuum pump 13 via each of milk receiving container 9, a sanitary trap 10, a pressure governor 11, and a vacuum tank 12. The milk receiving container 9 is provided to reserve the milked milk by the teat cup 1 and the sanitary trap 10 is provided to prevent the milk from flowing from the milk receiving container 9 to the pressure governor 11. The long air tube 7 is connected to an air pipeline 15 via a pulsator 14. That air pipeline 15 is connected to the vacuum pump 13 via each of the sanitary trap 10, pressure governor 11, and vacuum tank 12. In the pulsator 14, the long air tube 7 communicates with the air pipeline 15, and periodically switches between a state in which it is connected to the vacuum pump 13 and a state in which it is released to the air. In this manner, the external chamber 1b of the teat cup 1 is periodically switched between a vacuum state and an atmospheric state. In addition, reference numeral 16 designates a milk pump for discharging the milk in the milk receiving container 9 to the outside.

[0019]

A plurality of milking units U composed of the teat cup 1, short milk tube 3, short air tube 4, claw 5, long milk tube 6, long air tube 7, and pulsator 14 are connected to the milk pipeline 8 and the air pipeline 15 so that milk can be milked simultaneously from a plurality of cows.

[0020]

Next, based on Figure 3, a method for milking milk from a breast 2 of a cow with a teat cup 1 will be described.

[0021]

Each of the internal chambers 1a of four teat cups 1 is connected to the vacuum 13 via each of the short milk tube 3, claw 5, long milk tube 6, milk pipeline 8, milk receiving container 9, sanitary trap 10, pressure governor 11, and vacuum tank 12. Each of the external chambers 1b of four teat cup 1 is connected to the vacuum pump 13 via each of the short air tube 4, claw 5, long air tube 7, pulsator 14, air pipeline 15, sanitary trap 10, pressure governor 11, and vacuum tank 12.

[0022]

Therefore, while the attachment port 1C of the teat cup 1 is attached to the teat 2A of the breast 2, the internal chamber 1a of the teat cup 1 is always led to a vacuum state. On the other hand, the external chamber 1b of the teat cup 1 is periodically switched between the vacuum state substantially identical to that of the internal chamber 1a and the atmospheric state. That is, when the external chamber 1b is placed in a vacuum state, the pressures of the internal and external chambers 1a and 1b are substantially identical to each other. As shown in (a) of Figure 3, since the internal cylinder body 1B is maintained in cylindrical shape, the vacuum of the internal chamber 1a is acted to the teat 2A, and milk is sucked out. On the other hand, when the external chamber 1b is placed in an atmospheric state, the pressure of the external chamber 1b is higher than that of the internal chamber 1a. Then, as shown in (b) of Figure 3, since the internal cylinder body 1B is crushed, the vacuum of the internal chamber 1a is free of being acted to the teat 2A, and milk is free of being sucked out, the internal cylinder body 1B is pressed to the teat 2A, and the teat 2A is compressed. Hence, a state in which milk

is sucked out from the teat 2A and a state in which the teat 2A is compressed are periodically repeated, thereby intermittently milking milk from the breast 2.

[0023]

As described above, the milked milk by each of the four teat cups flows each of the four short milking tubes 3, and inflows a long milk tube 6 in a state in which the milt gathers at one point in the claw 5. The milked milk flows the long milk tube 6, inflows the milk pipeline 8. Then, the milk flows the milk pipeline 8, and inflows the milk receiving container 9.

[0024]

Now, an apparatus for diagnosing latent mastitis will be described with reference to Figure 1 and Figure 2.

[0025]

In the figures, reference numeral 17 designates an optical sensor provided with a light emitting unit 17A and a light receiving portion 17B; reference numeral 18 designates an optical fiber based projection light guide for guiding light from the light emitting unit 17A of the optical sensor 17 and projecting the light in the short milk tube 3 across the inside of the short milk tube 3; reference numeral 19 designates an optical fiber based reception light guide for receiving the projected light from the projection light guide 18 and guiding the light to the light receiving portion 17B of the optical sensor 17. Specifically, as shown in Figure 2, while an end face 18a of the projection light guide 18 is seen in the short milk tube 3, one end of the projection light guide 18 is provided on the tube wall of the short milk tube 3 by inserting the guide into the tube. On the other hand, while an end face 19a of the reception light guide 19 is seen

in the short milk tube 3, and is opposed to the end face 18a of the projection light guide 18, one end of the reception light guide 19 is provided on the tube wall of the short milk tube 3 by inserting the guide into the tube.

[0026]

Namely, a transmitted light quantity of the projected light from the end face 18a of the projection light guide 18 changes with an change in flow rate of the milk flowing the inside of the short milk tube 3, the light is guided to a reception light guide 19, and the quantity of light received by the light receiving portion 17B changes. Then, every milking job, an output signal generated with an change in light quantity from the light receiving portion 17B over milking job is integrated by weighing unit 20 in a control unit C utilizing microcomputers, so that the milking quantity of the teat cup 1 is calculated. That is, the optical sensor 17, projection light guide 18, reception light guide 19, and weighing unit 20 are configured so as to function as detecting means for detecting the milking quantity of the teat cup 1 every milking job. In addition, the detecting means configured as described preciously is provided for each of the four teat cups.

[0027]

Reference number 21 designates a processing unit in the control unit C. The calculated milking quantity of each of the teat cups 1 is divided by a total value of the calculated milking quantity of each of the four teat cups 1 at a calculating unit 21A of the processing unit 21 based on the calculation results of the milking quantity of each of the teat cups 1 at the weighing unit 20. In this manner, a rate of the milking quantity of each breast to the total milking

quantity is calculated, and the calculated rate is stored in a storage unit 21B of the processing unit 21.

[0028]

At a diagnosis unit 22 of the control unit C, an average value of the past calculation rate is calculated by the breast based on storage information of the past calculation rate stored in the storage unit 21B of the processing unit 21; and the present calculation rate calculated at the calculating unit 21A of the processing unit 21 is compared with the calculated average value. When the present calculation rate is smaller than the calculated average value by a predetermined value (for example, 5%) or more, the breast is diagnosed to be latent mastitis, and then the diagnosis results are displayed on a display unit 23 so that each of the four breasts can be identified. For example, a different code from each of the four breasts is set, and a difference in the code of the breast diagnosed to be latent mastitis and the present calculation rate and the calculated average value is displayed.

[0029]

[Another Embodiment]

Another Embodiment of the present invention are shown as follows:

(1) In the above embodiment, there is shown a case in which the light from the light emitting unit 17A is guided to the projection light guide 18, and is projected in the short milk tube 3 across the inside of short milk tube 3; and the light projected from the projection light guide 18 is received by the reception light guide 19, and is guided to the receiving unit 17B of the optical sensor 17. In place of the above, the light emitting unit 17A of the optical sensor 17 is provided on the tube wall of the short milk tube 3 by inserting the unit into

the tube so as to project the light in the short milk tube 3 while the unit 17A is seen in the short milk tube 3. In addition, the light receiving unit 17B of the optical sensor 17 may be provided on the tube wall of the short milk tube 3 by inserting the unit into the tube so as to receive the light from the light emitting unit 17A while the unit 17B is seen in the short milk tube 3 and is opposed to the light emitting unit 17A.

[0030]

(2) The present calculation rate is compared with storage information of the storage unit 21B of the processing unit 21 at the diagnosis unit 22. In the above embodiment, there is shown a case in which an average value of the past calculation rate stored in the storage unit 21B of the processing unit 21 is calculated, and the present calculation rate is compared with the calculated average value. In place of the above, the present calculation rate may be compared with the most recent calculation rate in the past calculation rate stored in the storage unit 21B of the processing unit 21.

[0031]

Reference numerals are assigned to ensure cross-check between claims and drawings conveniently. With such assignment, the present invention is not limited to the constituent elements of the accompanying drawings.

[Brief Description of the Drawings]

[Figure 1]

Figure 1 is a structural view of an apparatus for diagnosing latent mastitis.

[Figure 2]

Figure 2 is a sectional view showing a structure of mounting detecting means in the apparatus for diagnosing latent mastitis.

[Figure 3]

Figure 3 is a sectional view for illustrating a milking action by milking means in the apparatus for diagnosing latent mastitis.

[Figure 4]

Figure 4 is an overall structural view of a milking apparatus when the apparatus for diagnosing latent mastitis is applied.

[Description of Symbols]

1 Milking means

17, 18, 19, 20 Detecting means

21 Processing means

22 Diagnosing means

[Document Name] Abstract

[Abstract] (Amended)

[Object]

To provide a method and apparatus for diagnosing latent mastitis of a cow simply and at an earlier stage by dairy farmers.

[Constitution]

In a method for diagnosing latent mastitis of a cow, milk is milked from each of a plurality of breasts of a cow; the milking quantity of each breast is detected every milking job; a rate of the milking quantity of each breast to the total milking quantity is calculated based on the detected milking quantity; the present and past calculation rates are compared with each other by the breast; and if the present calculation rate is varied by a predetermined value or more compared with the past calculation rate, the breast is diagnosed to be latent mastitis. In addition, there is provided an apparatus for diagnosing latent mastitis of a cow including: processing means 21 for calculating a rate of the milking quantity of each breast to the total milking quantity and storing the calculated rate; and diagnosing means 22 for, when the present calculation rate and storage information of the processing means are compared with each other by the breast, if the present calculation rate is varied by a predetermined value or more compared with storage information of the processing means, diagnosing that the breast is latent mastitis.

Figure 2

#1 Milk

Figure 3

#1 Air

#2 Milk

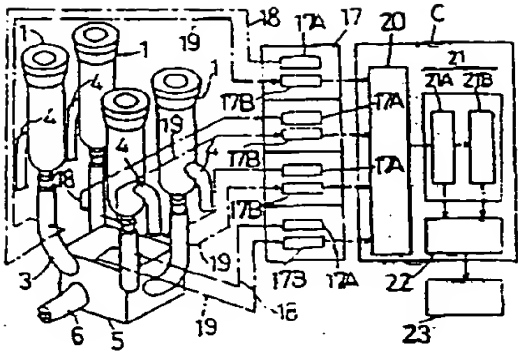
Figure 4

9 Milk receiving container

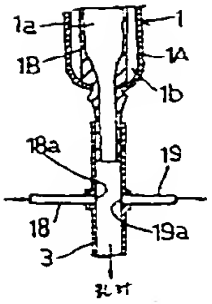
#1 Air

#2 Milk

【図1】


18
17A
17
20
C
21
21A
21B
17B
17A
19
1
4
3
6
5
22
23

【図2】


1a
1
1B
1A
1b
18a
19
18
19a
3

【図3】

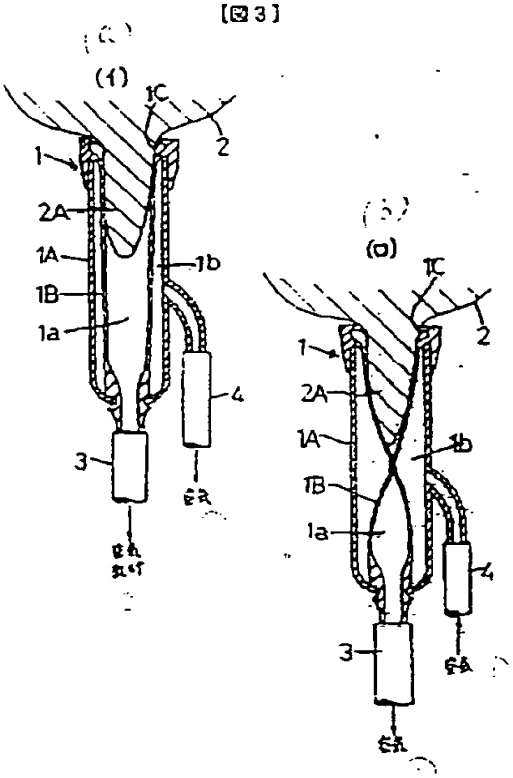

(イ)
1C
2
1
2A
1A
1b
1B
1a
4
3
(ロ)
1C
2
1
2A
1A
1b
1B
1a
4
3

図1/2 ×6

【図4】